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| 09/653,561 | 08/31/2000 | Larry Hillyer | M4065.0239/P239 | 5354 |
| 24998 | 7590 | 06/29/2004 | EXAMINER | |
| DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP | | | NGUYEN, HA T | |
| 2101 L STREET NW | | | | |
| WASHINGTON, DC 20037-1526 | | | ART UNIT | PAPER NUMBER |
| | | | 2812 | |

DATE MAILED: 06/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/653,561

Applicant(s)

HILLYER ET AL.

Examiner

Ha T. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 April 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4, 6-18, 20-31, 34-39, 41-44, 50, 52-95 and 97 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6-18, 20-31, 34-39, 41-44, 50, 52-95 and 97 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Notice to applicant

1. Applicants' Amendment and Response to the Office Action mailed 1-14-4 has been entered and made of record.

Claim Rejections - 35 USC § 112

2. Claims 30-38 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 30-38 recite the limitation "said contacting" in line. It is not clear which contacting step, of step b) or step c), the claims refer to.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103[©] and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 16, 29, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over in view of Zhao et al. (USPN 6204192, hereinafter "Zhao"), in view of Chen (USPN 5970376).

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Referring to Figs. 1-8 and related text, Zhao discloses a method for removing polymer etch residue from an etched opening in a silicon wafer device, comprising the steps of: contacting said opening with a first plasma to remove a portion of said etch residue, stopping said first plasma contacting before said polymer etch residue is completely removed and thereafter removing any remaining said residue by contacting said opening with a second plasma, said second plasma consisting of a hydrogen containing gas (See col. 4, line 37- col. 5, line 39). Zhao also discloses removing photoresist by oxygen ashing (see col. 1, lines 54-63). It is inherent that some residue is also removing in the ashing step. But it fails to disclose expressly first plasma consisting of oxygen. However, the missing limitation is well known in the art because Chen discloses this feature (See cols. 10 and 11).

A person of ordinary skill is motivated to modify Zhao with Chen to remove photoresist by a conventional process .

Therefore, it would have been obvious to combine Zhao with Chen to obtain the invention as specified in claims 16, 29, and 54.

Note: Because of the large number of claims the following rejection will mainly address the claimed features without, at every rejection, specifically indicate the identification number of all the claims containing the rejected features.

5. Claims 1-4, 6-18, 20-31, 34-39, 41-44, and 54-91 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhao in view of Smith (USPN 6277733)

[Re claims 1, 16, 29, 54, and 70] Zhao discloses substantially the limitations of claims 1, 16, 29, 54, and 70, as shown above. But it fails to disclose expressly the use of NH_3 or CH_4 .

However, the missing limitations are well known in the art because Smith discloses ammonia, H_2 , or CH_4 are equivalent gases for removing organic containing material (see col. 4, lines 8-26);

[Re claims 2 and claims reciting similar feature(s)] Smith also discloses wherein said opening is a HAR contact opening (see Fig. 2f);

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[Re claims 3 and claims reciting similar feature(s)] wherein said contacting is performed under conditions effective to remove said etch residue without substantially increasing the size of said opening (See col. 1, 54-56); and

[Re claims 4 and claims reciting similar feature(s)] wherein said opening is contacted with ammonia, H₂, or CH₄ gas in the absence of oxygen (See col. 4, lines 8-48).

[Re claims 6 and claims reciting similar feature(s)] Zhao also discloses wherein said contacting with said second plasma is done at a temperature within the range of about 250-500° C (see col. 5, lines 5-22);

[Re claims 12-13 and claims reciting similar feature(s)] wherein said contacting with said second plasma is performed for a period of less than about 100 seconds; for a period of not more than about 75 seconds (see col. 5, lines 23-39).

[Re claims 14 and claims reciting similar feature(s)] forming a conductive layer at the bottom of said opening following said contacting step (see col. 5, lines 40-51);

[Re claims 15 and claims reciting similar feature(s)] wherein said opening forming step produces silicon nitride at a bottom of said opening, said method further comprising said silicon nitride (see col. 4, lines 17-36);

[Re claims 26 and claims reciting similar feature(s)] wherein said bottom of said opening is not oxidized during said second plasma contacting step (see par. bridging cols. 4 and 5).

[Re claims 7-9, 11 and claims reciting similar feature(s)] Zhao discloses substantially the limitations of claims 7-9, 11 and claims reciting similar feature(s), as shown above. But it fails to disclose expressly the details about said opening and the conditions for applying the first or second plasma. However any variation in parameters in the present claims is obvious in light of the cited art, because the changes in parameters produce no unexpected function.

The routine varying of parameters to produce expected changes are within the ability of one of ordinary skill in the art. Patentability over the prior art will only occur if the parameter variation produces an unexpected result. In re Aller, Lacey and Hall, 105 U.S.P.Q. 233, 235. In re Reese 129 U.S.P.Q. 402, 406.

[Re claims 41-44] Zhao also discloses wherein an insulating layer is formed on said device prior to said etching and said etching forms a contact hole in said insulating layer by dry

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etching; said dry etching is performed using at least one gas selected from the group consisting of CH_2F_2 , CHF_3 , CH_2F_6 , C_2HF_5 , CH_3F (See col. 4, lines 17-36).

Therefore, it would have been obvious to combine with to obtain the invention as specified in claims 1-4, 6-18, 20-31, 34-39, 41-44, and 54-91.

6. Claims 50, 52-53, 92-95, and 97 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhao in view of Smith, as applied above, and further in view Kawai (USPN 6284664) and Hamada (USPN 6291890).

The combined teaching of Zhao and Smith discloses substantially the limitations of claims 50, 52-53, 92-95, and 97, as shown above.

But it fails to disclose expressly forming an insulating layer over a polysilicon region; forming a Ti silicide layer at the bottom of said opening in contact with said polysilicon layer.

However, the missing limitations are well known in the art because Kawai discloses forming an insulating layer 18 over a polysilicon region 14; forming a contact opening in said insulating layer down to said polysilicon region using a fluorine containing gas (see col. 4, lines 4-18); removing polymer residue from said contact opening using a gas (see col. 4, lines 26-58) and Hamada discloses forming a titanium silicide 111 at the bottom of an opening in contact with said polysilicon layer 104; forming a conductor 112 in said opening in electrical contact with said silicide (see Fig. 3D and col. 5, lines 1-20).

A person of ordinary skill is motivated to modify Zhao and Smith with Kawai and Hamada to obtain improved connection conductivity to a gate region.

Therefore, it would have been obvious to combine Zhao and Smith with Kawai and Hamada to obtain the invention as specified in claims 50, 52-53, 92-95, and 97.

Response to Amendment

7. In view of Applicants' cancellation of the claim, the rejection of claim 96 under 35 U.S.C. 103 is rendered moot.

In view of new art found the allowability of claims 16-18, 20-24, 27-31, 34-39, 41-44, 86-91 has been withdrawn.

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In view of Applicants' arguments and amendment to the claim, the rejections of claims 1-4, 6-18, 20-31, 34-39, 41-44, 50, 52-95, and 97 under 35 U.S.C. 102 or 103, as stated in the Office Action mailed 1-14-4 have been withdrawn.

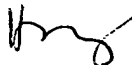
Applicants' arguments with regard to the rejections under 35 U.S.C. 103 have been fully considered, but they are not deemed to be persuasive. The response to these arguments have been incorporated in the new ground of rejection given above.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (571) 272-1678. The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week. The telephone number for Wednesday is (703) 560-0528.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Neibling, can be reached on (571) 272-1679. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



Ha Nguyen

Primary Examiner

06- 25 - 04